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a guide to
LOG DIAGRAMING
for eastern softwoods



NORTHEASTERN FOREST EXPERIMENT STATION • FOREST SERVICE
U. S. DEPARTMENT OF AGRICULTURE • UPPER DARBY, PA. • 1964

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This guide, which is intended as a step for standardizing procedures, diagrams, and records, is a counterpart of a similar manual, published by the Central States Forest Experiment Station, about diagramming hardwoods. Certain sections of this manual have been incorporated to meet the requirements for eastern softwoods. Also, portions of a similar publication covering procedures for diagramming western softwoods, issued by the Pacific Northwest Forest and Range Experiment Station, have been adopted for use in this guide.

a guide to
LOG DIAGRAMING
for eastern softwoods

by

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INTRODUCTION

THE usual purpose of diagramming logs is to record accurately all surface characteristics so that the relationship between these characteristics and the product or value yield of the log can be studied.

Any log-grade study we make may be considered a part of the service-wide effort to solve the broad problem of log- and tree-quality appraisal for a wide range of ultimate uses. Therefore, if diagramming is called for by the study plan, each diagram should contain accurate information completely and uniformly recorded so that it can be combined with data from other studies.

Correctly made, diagrams can be used and reused in many ways. For example, diagrams—together with conversion records—may provide all the necessary information for many types of analysis. They can be used to estimate yields by different log-grading rules for various products; they can be used to establish new or improved log-grading rules for various products, or to determine the effects of bucking practices on the value yield from a tree.

Diagrams of all sections of the same tree, considered as a whole unit, comprise what we call a *diagram of a tree*. Hence, *tree diagrams*, *tree diagramming*, and similar terminology as used here refer to a series of individual diagrams that as a whole represent all of the product units or potentially usable portions of a tree.

The procedures described here will be used to establish uniform minimum standards for diagramming eastern softwood logs and bolts, or felled and bucked trees, in the development of quality specifications. Although generally limited to logs and bolts, the procedures outlined in this guide are equally applicable to diagramming other products such as posts, poles, piling, or entire tree boles. Several aids and devices that can be used in diagramming are also described.

It is not intended that diagramming be limited only to the abnormalities or characteristics that are considered grade-determining in current grading rules. Other abnormalities or characteristics, not included in the current grading rules, may in the future be incorporated into rules for evaluating the yield of a log or tree.

The procedures outlined here are minimal; they do not preclude collecting additional or more detailed information. Although these procedures have been well tested in the field, better

ones may be found. If so, supplements or revisions will be issued. Procedures for recording preliminary data on trees selected for study are not included because those instructions are included in individual study plans. And procedures for diagramming standing trees have not been included. When demand justifies publication of such information, a supplement will be added to cover such procedures.

DEFINITIONS

The following definitions of terms used in this guide are offered to assure common agreement on meaning.

Grade Defects

Defect. An abnormality in the bark surface or ends of a log, which indicates that the wood in the underlying peripheral zone is or may be degraded for its intended use.

This term is defined in considerable detail in *Grade defects in hardwood timber and logs*⁴, for softwoods as well as hardwoods, as follows:

Defects fall into two main categories: (1) those which reduce the volume of sound wood or lower its durability, and (2) those which lower its strength or otherwise limit its utility. The first category comprises the so-called *scalable defects* (chiefly rot, shake, and checks), and their product-loss effect is allowed for in scaling. The second comprises the *grade defects*—e.g., knots, stains, holes, and bark pockets, which are generally not removed in primary manufacture. Grade defects control the quality of the part of the log expected to yield unblemished wood, and are basic determinants of strength, durability, or fine appearance.

The term "defective timber" popularly connotes rotten or over-mature trees, even though these may contain much usable material. The amount of scalable defect, together with size limitation, is often the main criterion limiting merchantability of logs or trees in commercial practice. Actually, timber from which usable material (scalable defect) will be removed in manufacture is not necessarily defective; there may be no serious blemishes (grade defects) in the remaining usable wood.

On the other hand, perfectly sound trees (without scalable defect) may be worthless because of the prevalence of grade defects which cannot be eliminated in manufacture. Since a defect that reduces volume (e.g., rot) is entirely different from a defect that reduces utility

⁴Lockard, C. R., J. A. Putnam, and R. D. Carpenter, *GRADE DEFECTS IN HARDWOOD TIMBER AND LOGS*. U. S. Dept. Agr. Handb. 244. 39 pp., illus. 1963.

(e.g., knot) the terms "scalable defect" and "grade defect" are good ones to express this difference. The latter should be applied only to those imperfections that lower the quality of the product into which sound wood in the tree or log will be converted.

Usage gives the term grade defect to abnormalities or irregularities on the log surface as well as to imperfections in the wood. These outside features are really indicators of imperfections in the underlying wood and could be termed "grade defect indicators." For example, a branch stub is an indicator of a knot in the product to be sawed from the log. Nevertheless, because timber appraisers deal with logs or tree stems as such, and not as sawn products, this publication designated these surface features as *log grade defects* or *degraders*.

Trees and Tree Sections

Felled and bucked trees. The entire bole of a tree, including all its sections as defined below, plus any unmerchantable top material.

Tree section. A portion of a tree stem bucked into a long timber, log, bolt, or cut.

Long round timber. Pieces 20 feet long or longer. Generally cut for use in original form for such products as piling and poles.

Log. Pieces 8 feet and longer. Generally used for lumber, ties, and structural elements. Usually processed on a head saw.

Bolt. Pieces nominally 8 feet and less in length. Softwood bolts are normally used for such items as pulpwood, posts, mine materials, cooperage, veneers, box shook, and other items usually made from short materials. Pieces to be sawed can be processed on either a bolter or head saw.

Cut. Cull pieces of material resulting from the bucking out of rotten, crooked, or crotched portions of a tree from merchantable sections described above. They may be further designated as jump butts and jump cuts depending upon their position in the tree.

The lengths stipulated for bolts and logs overlap. For example, an 8-foot (plus trim) length of material for veneering would be classified as a bolt. If destined for conversion into a tie or lumber, this same section would be classified as a log.

THE DIAGRAM FORM

The form recommended for use in diagraming is *Eastern Softwood Log Diagram Form ESLGP-1*. It is printed on a good grade of paper to withstand field conditions and frequent use during

analysis. The reverse side of the form contains a list of the abnormalities, their symbols, and a key to the dimensional measurements used in recording. Sample forms are attached at the end of this publication. Copies can be obtained from log-grade project leaders at either the Northeastern or Southeastern Forest Experiment Stations.

Instructions for Use of Form

Form ESLGP-1 will accommodate material up to 16 feet long plus trim allowance. Where logs or other sections are not to be combined to make up a tree diagram, use a separate form for each item up to 16 feet in length (plus trim allowance). If poles, piling, or logs more than 16 feet long are being diagrammed, use a separate form for each 16-foot length or fraction thereof. Identify each diagram as 1, 2, 3, etc., of that particular tree section.

When diagraming felled and bucked trees to provide a tree diagram, use a separate form for each section up to 16 feet (plus trim allowance).

Explanation of Captions and Entries To Be Made on the Diagram Form

The following explanations and instructions apply to data to be recorded on the diagram form. It should be noted that some entries—marked here with an asterisk—can be made later in the office. All other entries should be made at the time of diagraming.

Tree No. Consecutive tree numbers will be assigned to study trees beginning with 1 on the first area sampled. Record the appropriate number from the tree/log-end tag. This procedure is not applicable on studies where items are not to be combined to make up a tree diagram.

Section No. — of —.

For sections that are not a part of a tree diagram.—Assign a consecutive number to each section (log, bolt, etc.,) that is to be diagrammed, and enter this number in the space provided on the form. Draw a line through the space after *of*.

For sections of felled and bucked trees.—A consecutive number will be assigned to each section of the tree beginning with 1 for the butt section. Record the appropriate number from the log-end tag. In the space after — *of* —, enter the total number of sec-

tions in the tree, including all jump butts and jump cuts that have received a number.

Diagram No. — of —. To be completed only when two or more diagrams are necessary to complete the record of a single section exceeding 16 feet long. Each diagram will be assigned a number. In such situations the total number of diagrams for a tree will exceed the total number of sections diagramed. Enter the diagram number and the total number of diagram forms completed for the section.

Product. Show the kind of product being diagramed: for example, *sawlog, veneer bolt, pole, piling, pulpwood*. Jump-butts and cull portions cut out above the first usable product should be identified as *jump-cuts*.

Species. Enter common name of tree species, followed by Forest Survey code in parentheses.

Mill or operation. Assign a number to each mill or logger.

Location. It is sufficient to locate the sample area on the usual Forest Service map of the area (quarter section, township, range).

(*Log scaling.* — On studies conducted on National Forests, logs will be scaled in accordance with Forest Service scaling handbook procedures by the regional or local check scaler, and will be recorded in a conventional Forest Service scale book. This data will be transferred later to the diagram form. On studies conducted on private timber, the study leader or designated experienced scaler should complete this record according to procedures outlined in the study plan and should transfer such data to the diagram form.)

***Scaling diameter.** This will be an office entry from the scale book completed by the regional or National Forest check scaler or other designated person.

Length. Enter the total overall diagramed length in feet and inches to the nearest inch (16⁶ means 16 feet, 6 inches). Measure with tape or log-measuring stick. On logs with slanting end cuts, record the shortest length. On butt logs, measure from the back cut—not the under cut. Across the diagram faces draw a vertical line at the appropriate log length and x out the unused portion of the diagram. (See sample form No. 4.)

***Gross Scale.** Gross scale, International 1/4-inch rule and Scribner Decimal C rule, to be computed or taken from scale-book records and entered later in the office.

***Scale deductions.** This will be an office entry from the scale book. Enter by cause (sweep or crook, rot, or other) the total

board-foot deduction to the nearest 10 feet for the Scribner Decimal C rule and to the nearest 5 feet for the International 1/4-inch rule. Indicate the actual cause of other than sweep, crook, or rot. In actual analysis of diagrams, deductions will be recomputed on the basis of actual measurements of sweep, rot, etc., given on the diagrams. Any changes due to discrepancies must be agreed upon by the scaler.

***Net Scale.** This will be an office entry from the scale book. Enter both Scribner Decimal C and International 1/4-inch net log volumes.

Log or section faces. The four faces of the section (the bark surface) are represented on the diagram form by the four horizontal graduated outlines that are numbered, from the left end, 1, 2, 3, and 4. The graduations will serve as guides in drawing the surface characteristics to scale. Procedures for recording log characteristics are given elsewhere in this guide.

End diagrams. These are located near the lower margins of the form, and they are used for recording the shape of the log ends and the shape of defects in the ends of a log. The numbers adjoining each quarter circle refer to the log face location. If no defect is present, enter a "C" in the end diagram to indicate that the ends are clear. Space is provided below each end diagram for entering the long and short axis diameters to the nearest 1/10-inch inside the bark. When these measurements differ by more than 1 inch, sketch in the irregularity. Record this information for every section that is diagramed.

Bark thickness. Space is provided at the lower right-hand corner of the form for recording the average bark thickness to the nearest 1/10 inch, measured at the top end of the log or section.

Width of sap. Space is provided at the lower right-hand corner of the form for recording the average width of sapwood to the nearest 1/10 inch, measured at the top end of the log or section.

Crook and sweep. Record the necessary indicated measurements on the sketches between the two log-end diagrams. On logs or sections with multiple crook or sweep, make additional sketches as needed under *Comments*. (For definitions of *sweep* and *crook*, see pages 10 and 14.)

Comments. Record in this space any significant information about the log that is not recorded elsewhere on the form. Examples of information that might be noted are unusual bark formation, mud on log, and the like.

Recorder and date. Record initials of diagraming crew and date of diagraming. Show the recorder's initials first.

Growth rate. This information should be recorded in the spaces provided for each butt section diagramed. The points at which each *definite change* occurred in the rate of growth should be shown by a vertical line on the horizontal line—see illustration below. A *definite change* is defined as follows:

<i>Average number of rings per inch</i>	<i>Change in growth rate (minimum number of rings per radial inch)</i>
1-5	1
6-10	2
11-20	3
21-30	4
31-50	5
51+	(⁵)

In deciding if a definite change occurred, always use the lower average number of rings per inch as the base. Take measurements at the top of the butt section only.

The distance from the pith to the first change and then between changes should be shown on the diagram form (extreme right side) above the horizontal line. Show the average number of rings per inch for each group below the horizontal line. Separate each growth-rate group proportionately with vertical lines, as indicated in the example below:

Growth Rate:			
6 1/2"	3"	3"	
Pith 6	9	Per	//

Rings in outer
radial inch //

⁵If average number of rings per inch is more than 50, ignore changes in growth rate.

Count the number of annual rings in the outer radial inch, and record them in the space provided.

***Log grade.** Space is provided for recording the grade of the log or section by one of three different grading systems. Indicate system and grade for all systems applied.

Defect symbols. On the reverse side of form ESLGP-1 is a list of the characteristics or defects that are to be indicated on the diagram form and the code symbols or abbreviations that are to be used. It also contains a numerical key for quickly identifying the measurements that are to be recorded for each, as explained in the note on the bottom of the form. If other abnormalities are to be recorded in accordance with a study plan, the names and symbols for the additional characteristics should be added.

LOG CHARACTERISTICS AND MEASUREMENTS

A log diagrammer must be able to identify accurately each of the many kinds of abnormalities. The following pages cover the abnormalities that are generally considered to be defects and that should be recorded on the diagrams. To facilitate accurate identification of log characteristics, brochures are being prepared on the defects of various species. These brochures will be made available to diagramming crews through the project leaders at the Northeastern and Southeastern Forest Experiment Stations. Whenever such brochures are not available, personal training will be given to crews by the project leaders or other trained personnel, using whatever training aids are available. The term *log*, as used in this section, includes any tree section.

Bark-Surface Characteristics: Code, Definition, and Measurement

Surface characteristics should be labeled, coded, or classified only by what can be determined by visual inspection of the surface. Whether or not a particular characteristic is currently considered as a grading defect is immaterial. If there is evidence of a defect on a log end, record it, but do not let such evidence influence the classification of what appears on the adjacent bark surface. It may be necessary in the course of training to chop into a log to learn the cause of a particular blemish. However, when actually diagramming, do not chop into a log to decide what to call a particular surface characteristic.

Take all length, width, and depth measurements of surface characteristics to the nearest 1 inch unless otherwise instructed. Length and width measurements are vertical and horizontal, respectively, to the ground as a tree grows. Length and width measurements should be taken at right angles to each other. Width, height, and depth measurements at the ends of face diagrams should correspond, where applicable, with measurements shown on the end diagrams. The term *height* refers to the extent of protrusion, and the measurement should be to the nearest $\frac{1}{2}$ inch unless otherwise stated.

Bark distortion (D). A break or alteration in the normal pattern of the bark, without apparent and definite cause. Sketch in the shape and location, measure length and width, and record to the nearest inch. (See sample form No. 2, face 2.)

Bird peck. Holes made by sapsuckers in the bark or through the bark into the cambium layer. The holes may be open, partially occluded, or completely filled with callus tissue. Sketch the affected area on the diagram form, measure the length and width of the area affected when there are four or more holes per square foot, and record the number per square foot. (See sample form No. 4, face 3.) Otherwise, record individual holes with a dot and without measurements. It is important that bird peck be described as follows:

Open bird peck (OBPk).—Peck holes are open, not occluded by callus tissue, indicating that peck is fresh or did not injure cambium.

Closed bird peck (CBPk).—Peck holes are partially or completely occluded by callus tissue, or covered by overgrowths, indicating callus material and stain in the wood.

Blister rust (BRT). Dead or discolored areas of blister rust infection on bark surrounding infected limbs. Old infections are often characterized by depressed dead areas on bark surface. Affected areas are sometimes girdled by porcupines. Measure and record length, width, and depth of area affected. (See sample form No. 2, face 3.)

Bulge (Bu). A general enlargement entirely around the circumference of a portion of a log, giving a barrel-like appearance, and usually indicating the presence of internal rot. If the bulge is entirely on the log, measure the length from the points where it departs from and returns to the normal taper of the log. Also

record the diameter at the maximum point of the bulge. If a cut falls within a bulge, take an additional diameter measurement at the point of cut. (See sample form No. 4.)

Bump (B). A gradual or abruptly rising protuberance, covered with bark, showing no scar, and having a normal bark pattern with a height/length ratio of more than 1 inch in height to 12 inches in overall length. (For discernible changes in log contour with a lesser height/length ratio, see *Surface rise*, page 14.) Measure length and width to nearest inch, and height to nearest $\frac{1}{2}$ inch. (See sample form No. 4, face 1.)

Burl (BL). A sound, hard, woody protuberance, more or less rounded or horizontally ridged in form, with no protruding limbs, twigs, stubs or indications of any. It differs from a bump in that it often resembles a rounded surface extrusion from the log. Often its maximum diameter is not at the point of contact with the log. It may vary in size from a small knob to a large excrescence that goes completely around the log. Measure the same as a bump. Sketch size and shape at point of occurrence. (See sample form No. 4, faces 3 and 4.)

Butt scar (BS). Generally a triangular-shaped break in the bark or wood at the butt end of the first log, caused by fire, logging, or other means. The length, width, and depth should be shown on the affected face or faces and on the large-end diagram. (See sample form No. 2, faces 3 and 4, and large-end diagram.)

Butt swell (SWL). An enlargement over and above the normal butt taper that usually, but not necessarily, extends around the butt end of a log. Generally butt swell is not associated with decay. It is common in cypress but is seldom found in pine or fir. Its length should be measured from the cut at the butt end of the log to the point where it conforms with the normal taper. (See sample form No. 1, faces 1 and 4.)

Canker (Ca). A necrotic-type lesion of cambium and bark, partially open and accompanied by a swelling of the stem. It is often associated with pitch. Measure length, width, and depth, and sketch size and location on appropriate faces of log diagram. (See sample form No. 1, face 1.)

Conk (Co). The fruiting body of a fungus, denoting the presence of rot. The conk may be of various shapes and sizes. Its location on the log should be shown by sketch, and the length and width of the area at point of attachment to log should be

measured. (See sample form No. 1, face 3.) The fungus that caused the conk should be identified and the name recorded under *Comments*. (See also *Punk Knot*.)

Crook (Ck). Crook differs from sweep in that it is analogous to a deflection angle deviating from an axis determined by the major straight portion of a log. The length of the crook should be measured to the nearest foot, and width to the nearest inch, and these should be recorded on the schematic drawing on the diagram form. (See sample form No. 3.)

Flanges (Flg). Buttress or winglike formations starting at the base of the tree and extending up the tree for varying heights. The wood in flanges is, by definition, outside the milling frustum. The length and width should be shown on the affected face diagram. (See sample form No. 1, face 2, and large-end diagram.)

Flute (Flt). Flutes may be mistaken for flanges, but they differ in that the convolutions are deep enough to penetrate the milling frustum and may include ingrown bark. Measure the same as flanges, and show the depth of convolutions inside the normal butt taper. (See sample form No. 1, face 4, and large-end diagram.)

Holes. Should be described whenever possible by cause and identification as:

Worm hole (WH). — A hole made by a wood boring insect such as ambrosia beetles and pine sawyers. Classify hole size as follows: *pin* (WH-P) if not over 1/16 inch in diameter; *medium* (WH-M) if over 1/16 inch but not over 1/4 inch in diameter; and *large* (WH-L) if over 1/4 inch in diameter. Measure and record length and width of affected area to the nearest inch and sketch shape and location. When worm holes occur in scars, diagram them as part of that characteristic. (See sample form No. 2, faces 3 and 4 and large-end diagram.)

Other large holes (OH). Unoccluded openings greater than 1/2 inch in diameter, caused by rotten knots, bird excavations, and mechanical damage. Measure length, width, and depth of hole. Use a probe to determine depth.

Log knot. The remnant of a branch, including limbs, limb stubs, overgrowths, or any indications of where a limb grew. Locate the center of these characteristics on the diagram form with a dot. Sketch their shape to scale around the indicated center and

record with the appropriate symbol. (See sample forms No. 1 and No. 3.) Record average knot diameter, using the following size classification:

- $\frac{1}{2}$ = $\frac{1}{2}$ inch or less
- $\frac{3}{4}$ = over $\frac{1}{2}$ inch but not over $\frac{3}{4}$ inch
- 1 = over $\frac{3}{4}$ inch but not over 1 inch
- $1\frac{1}{2}$ = over 1 inch but not over $1\frac{1}{2}$ inches
- 2 = over $1\frac{1}{2}$ inches but not over 2 inches
- $2\frac{1}{2}$ = over 2 inches but not over $2\frac{1}{2}$ inches
- 3 = over $2\frac{1}{2}$ inches but not over 3 inches
- 4 = over 3 inches but not over 4 inches
- . . . and so on.

When a log knot occurs on the boundary between two diagramming faces, sketch the proportional part in each face. (See sample form No. 1, faces 3 and 4.) Specific measuring instructions and details of log knot classification and recording are as follows:

Live log knot (\odot). A knot intergrown with the surrounding wood at the log surface, with no indications of decay. Bark is usually present on the limbs that result in this type of log knot. Measure average diameter inside bark at log surface. Do not include any of the swelling sometimes present at the limb collar. Whenever the limb size (including sapwood) is more than 1 inch larger than the heartwood, diagram the knot as two concentric circles. Record two diameters: one overall and one the size of the heartwood only. For example: \odot 6/3 means a live log knot 6 inches overall with 3 inches of heartwood.

Dead log knot (\bullet). A dead limb not intergrown with the surrounding wood at the log surface but showing very little or no sign of deterioration. It may be stained but is as hard as surrounding wood, and is known as *encased* in the resulting lumber. Bark is usually absent from a limb resulting in this type of knot. Measure only the average diameter of the dead material. Ignore surrounding callus tissue. Record as for a live knot, but fill in the circle with pencil.

Rotten log knot (\odot R) or (\bullet R). A live or dead limb or stub showing rot. Show type of log knot by appropriate symbol, record the size, followed by an R to indicate that the log knot is rotten.

Punk log knot (\bullet P). Also referred to as a *blind conk*, this is an overgrown or partially overgrown rotten knot occupied by brownish fungus tissue. The bark at point of occurrence is usu-

ally abnormally protruded. Measure the diameter of the area occupied by fungus tissue and record it as a dead log knot followed by P.

Bleeding log knot (●RB) or (●PB). A rotten or punk limb knot from which pitch has exuded to form a streak on the bark surface. Indicate with appropriate symbol, followed by a B. Also indicate degree of pitch, or by recording the length of the streak, to nearest 0.1 foot after B.

Acute-angled log knot. Any log knot that has an angle of departure from the central axis of the tree section of less than 45 degrees. Indicate with a check mark following the appropriate log-knot symbol. (See sample form 3, face 2.)

Overgrown log knot (X). The scar left in the bark by a limb that has been completely overgrown but is clearly outlined by circular or other configurations in the bark. Measure the average diameter to the outer edge of the overgrowth pattern, ignoring any extremes in bark pattern. In butt logs of young trees, the overgrowth pattern is frequently two elongated half circles that occur on the sides of a bark fissure. In such cases the diameter of the half circle is the overgrowth size. Indicate this with an X placed over the center of the overgrowth location and record the size alongside.

Cluster knot (KCL). Two or more limbs that grow in a more or less inseparable group and are usually elevated above the normal bark surface. If the cluster contains only two log knots, diagram both as single log knots. If more than two, sketch the outline of the cluster to scale and show the symbol KCL. Within the outlines, locate the center, and show the character and size of at least four of the most prominent log knots. Measure length and width of the cluster to the nearest inch and height (if applicable) to the nearest 1/2 inch. (See sample form No. 3, face 3.)

Adventitious branch or bud (AB). A small sprout-type limb or bud, 1/2 inch or less in diameter, that originates from a dormant bud and is unrelated to the normal branching. It may occur at any time during the life of the tree. If single, record it with a dot and AB. If in the cluster, diagram two or three small dots and show AB alongside. (See sample form No. 1, face 1.) No measurements necessary.

Mechanical damage (MD). This includes cracks, splits, brooming, splinter pull, "barber chair," holes, etc., that result from felling, skidding, or loading. Measure length, width, and depth. Explain type of damage in space provided for comments unless already indicated on an end diagram. (See sample form No. 3, faces 1 and 2, and large-end diagram.)

Sap rot (SR). Decay in the sapwood portion of a tree section, not identifiable with a log knot. Measure length, width, and depth, and show visible area on the diagram by solid lines; and if possible show the estimated non-visible area by dotted lines. The depth is usually equal to the sapwood thickness. The fungus or fungi that cause the rot should be identified if possible and recorded under *Comments*.

Seams. Seams are longitudinal radial separations of the fibers in a log, and they may be either open or overgrown with callus tissue. They are usually caused by wind, frost, or lightning. Accurately sketch location and shape of affected area on all faces and end diagrams. (See sample form No. 3, face 3.) Measure length, width, and depth to the nearest inch. The amount a seam deviates from a line paralleling the long axis of a log should be shown to the nearest inch and identified as *Deviation*. If rot is associated with a seam, measure or estimate depth. If pitch is associated with seam, indicate with **P** following appropriate symbol.

A seam should be classified as one of the following:

Open, sound (OSS). — Seam is open, not covered by callus tissue, and shows no indication of rot.

Open, unsound (OSU). — Seam is open, not covered by callus tissue, but shows presence of rot.

Overgrown (GS). — Seam overgrown by callus tissue.

Sweep (Swp). A gradual deviation from a straight line extending from one end of a log to the other, analogous to the middle ordinate deviation of an arc from its chord. Measure the amount of deviation (width from chord to arc at its maximum) to the nearest inch and show it by curved lines above and below the affected faces on the diagram. Record the measurement on schematic drawing of sweep on diagram form. (See sample form No. 4.)

Surface rise (SUR). The same as a bump except that it has a ratio of height to overall length of not more than 1 inch to 12. The minimum would be one that is noticeable (probably $\frac{1}{4}$ to

1/2 inch high). Sketch the shape and location of the affected area, and record the length and width to the nearest inch and the height to the nearest 1/4 inch.

Undercut (UC). The slice of wood removed from a tree before felling to help control direction of fall. Record maximum length, width, and depth to the nearest inch, and sketch the shape of the undercut on the appropriate diagraming face(s). (See sketch below (fig. 1) and sample form No. 2, faces 1 and 2, and large-end-diagram.)

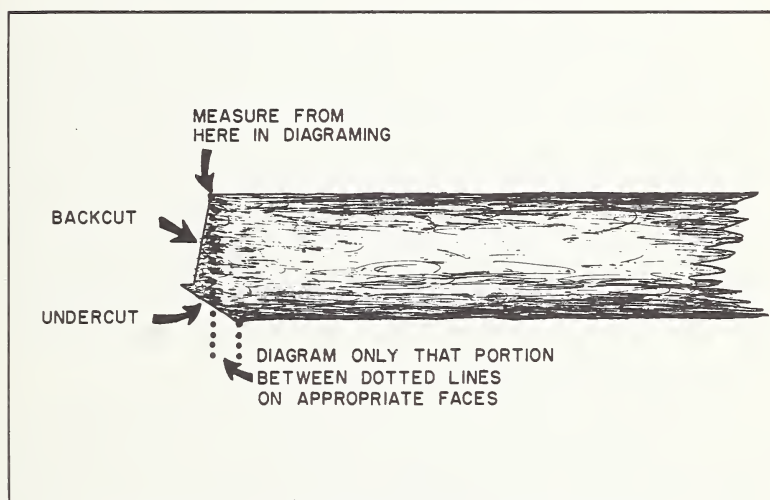


Figure 1. — Procedure for diagraming undercuts.

Weevil injury (W). Evidence of weevil injury can be recognized by moderate to severe crook at point of injury. Damage is limited to white and red pine. Knots at point of injury are usually large and elongated. Crook is more severe in small logs and less evident in large logs. Indicate with W at point of occurrence on log surface. (See sample form No. 3, face 2.)

Wounds or Scars. Damage to the stem due to natural causes such as a tree or limb falling against another tree, or to logging. Classify such damage as *sound* or *unsound* according to the wood underneath. Accurately sketch outline of the affected area and measure the length, width, and depth to the nearest inch, and

sketch to size on appropriate faces of diagram form. (See sample form No. 3, face 2.)

Sound (SW). The wood underneath is sound. Callus overgrowth may be open or closed or any degree of coverage of the wound.

Unsound (UW). The wood underneath is unsound. Callus overgrowth may be any degree of coverage.

Log-End Characteristics: Code, Definition, and Measurement

In measurements of the following characteristics, *length* refers to the longest measurement and *width* refers to the shortest measurement of a particular characteristic. *Depth* means distance into the log and is determined or estimated only for certain characteristics. *Length and width measurements should be taken to the nearest 1/2 inch and depth to the nearest inch unless otherwise stated.* The defects should be sketched on the respective log-end diagrams on the diagram form. The distance from the edge of the defect to the log center or perimeter should be indicated when not apparent from the sketch. When the defect is also indicated on a face diagram, the diagrams should correspond for applicable items.

Bark pockets (BP). A pocket or patch of bark, either in single or multiple occurrence, surrounded by wood. Measure length and width. When pockets are less than 3 inches apart, measure the entire affected area. Sketch to scale on log-end diagram.

Bird peck (BPk). Described under *Surface Characteristics*. Measure length and width of the area affected when there are four or more pecks per square foot, and record the number per square foot. Sketch in the affected area on the end diagram. Otherwise, record individual pecks with a dot, without measuring.

Bulge (BU). Described under *Surface Characteristics*. If a bucking cut has been made through a bulge, indicate the bulge on the respective end diagram. The height or diameter measurement can be calculated from the data recorded for the log surface. However, it is easier to show the normal taper diameter on the end diagram by using a broken line and to record the measured height or diameter and length of the bulge.



Bump (B). Described under *Surface Characteristics*. If a bucking cut goes through a bump, show the protrusion by a broken line on the end diagram and record the length and height (width).

Burl (Bl). Same as for bump.

Butt scar (BS). Described under *Surface Characteristics*. The length and width should be shown. Sketch the shape to scale on the appropriate log-end diagram. (See sample form No. 2 face 3, and large-end diagram.)

Compression wood (CW). Abnormal wood that usually occurs on the lower side of branches and inclined trunks of coniferous trees. It is marked by a greater than normal proportion of summerwood to springwood. Sketch the affected area and record its dimensions to the nearest inch. (See sample form No. 4, small log-end diagram.)

Double pith (DP). When a bucking cut has been made at the base of a fork in the tree bole, two piths may be evident. Often, when this occurs, the two piths will be separated by a long narrow strip of bark. This bark should be measured and labeled the same as a bark pocket. Measure the distance between the two piths and from each pith to the perimeter on a straight line, to the nearest inch. Any out-of-round or figure 8 character should be measured and sketched on the log-end diagram. (See sample form No. 2, small-end diagram.)

Flanges (Flg). Described under *Surface Characteristics*. Show the width and length (height) above normal the contour on the end diagram. (See sample form No. 1, large-end diagram.)

Flutes (Flt). See *Surface Characteristics* for description. The width and length (depth) of the convolutions inside normal butt taper should be shown on the end diagram. (See sample form No. 1, large-end diagram.)

Heart check (HC). Heart checks (spider heart, pith spangle, wind shake) are separations of the wood in a radial direction from the pith outward. They are sometimes confined to the heart center but may go to the perimeter of the heartwood. Damage usually is most serious in butt cuts but may extend the entire length of the bole. Measure length to the nearest inch, and width of checks to the nearest $\frac{1}{8}$ inch. If checks are numerous, record the average diameter of the affected area. No estimate should be made of extent of penetration into the log. Indicate pitch-

filled checks with a P. (See sample form No. 1, large-end diagram.)

Holes. Described under *Surface Characteristics*. Measure length and width, sketch in affected areas, and code the same as on log surface.

Log knot. A section or limb visible in a log end. Shape will vary according to angle the limb makes with the plane of the bucking cut. Sketch to scale. Use bark-surface codes and instructions to indicate type and size of knot. If knot is partially dead, pencil in the dead portion of the sketch and record its length. (See sample form No. 3, face 4, and small-end circle.)

Off-center pith (OC). When pith is more than 2 inches from the geometric center, show the lengths of the shortest and longest radial axes.

Mechanical damage (MD). Damage or defects caused by felling, such as splits, splinter pull, and "barber chair." Measure length and width and indicate type of damage on the end diagram. (See sample form No. 3, faces 1 and 2 and large-end diagram.)

Pitch, massed (MP). A clearly defined accumulation of resin in a body by itself. (Ignore fresh pitch.) Measure length and width of the affected area to the nearest inch and sketch on appropriate log-end diagram.

Pitch ring (PR). A clearly defined accumulation of pitch more than 4 inches long, following along the annual growth rings. It may be a partial or complete circle. If the ring is a full circle, measure and record the diameter of the circle to the nearest inch. If the ring affects only a portion of the circle, measure the chord of the arc described to the nearest inch. Measure width (opening) of all pitch rings to the nearest $\frac{1}{8}$ inch if they exceed $\frac{1}{8}$ inch. Sketch in the location and shape, and record the radial distance from the log perimeter to the ring or arc. (See sample form No. 3, end diagrams.)

Pitch pocket (PP). A well-defined opening between the growth rings less than 4 inches long, usually containing, or which has contained, an accumulation of pitch. Measure the length to the nearest $\frac{1}{2}$ inch and width to the nearest $\frac{1}{8}$ inch if it exceeds $\frac{1}{8}$ inch.

Ring shake (RS). Ring shake is a tangential separation of fibers along the annual rings. It may be found as a partial circle

in the heart center, or as a complete or partial circle outside the heart center. Measure length and width as for pitch rings.

Rot. Decay due to wood-destroying fungi. The importance of types of rots varies by species and location. Additional instructions may be necessary for each study where logs are to be diagramed. Sketch all rots to scale on log end circles and shade in the affected area. Measure and record the maximum length and width to the nearest inch. If possible, also record the causal fungus and the stage (incipient, advanced, or broken down) to which the infection has progressed. (See sample form 1, small-end diagram.)

Butt rot (BR).—Decay in the butt log or section, usually confined to the stump end, but sometimes showing at the upper end. Common types and causal fungi are brown cubical rot (*Polyporous schweinitzii*) and white spongy rot (*Fomes annosus*).

Trunk rot (TR).—Decay in the heartwood zone of a log. Common types and causal fungi are: red rot or red ring rot (*Fomes pini*), brown pocket rot (*Fomes geotropus* and *Trametes subrosea*) and red heart rot (*Stereum sanguinolentum*).

Sap rot (SR).—Decay in the sapwood zone of a tree. Wood is discolored and spongy. Measure and record the thickness of the affected ring to the nearest 1/2 inch.

Seams (OSS, OSU or GS). Defined under *Surface Characteristics*. Record length and width, and sketch shape to scale on appropriate log-end diagram. (See form No. 3, face 3, and large-end diagram.)

Stain (St). Other than mineral. Found only in recently scarred or dead wood, its appearance usually signifies some stage of fungus or bacteria activity. Measure length and width. Also indicate color intensity of stain—i.e., heavy blue, light pink, medium brown, and so on. Sketch to scale on appropriate log-end diagram.

Surface rise (SUR). See *Surface Characteristics*. If a bucking cut goes through a surface rise, record length, width and height.

Wounds (SW or UW). See *Surface Characteristics*. If a felling or bucking cut goes through a wound, indicate it on the respective end or cross-section diagram. Record length and width as explained for butt scar.

DIAGRAMING PROCEDURES

Work plans for tree-log-grade or tree-grade studies will generally specify sample size by geographical location, d.b.h., butt-log quality, merchantable height, age classes, and so on. In addition, other specific data on study trees will usually be desired before felling or bucking is done. Such information will be specified in individual study plans and will include such procedures as tree-section orientation lines, bucking instructions, and the like.

General Precautions and Considerations

All surface and end abnormalities must be recorded on the diagrams. Generally, only those logs with bark will be diagramed. Debarked logs have lost many of the defect-identifying characteristics. However, there may be special studies where items both with and without bark may be diagramed to compare ability to recognize defects under each condition.

Defects or characteristics should be sketched to scale in a shape comparable to the actual shape of the defect. The dimensions required should be entered beside the sketch.

When a characteristic occurs at or near the face edge and extends into the adjoining face, it should be so recorded on the form together with the dimensions involved.

Defects and dimensions that are shown on both end and face diagrams should correspond with each other. Estimates of non-visible areas should always be indicated with a broken-line sketch. Here again, *log* is used in a general way in the following and should be considered, where applicable, to include other stem sections.

Since most of the diagrams will be used to evaluate the effect of surface indicators on product yield, it is extremely important that the diagramer should number each log so that the identifying number can be readily seen when the log arrives at the carriage. When felled and bucked trees are diagramed it is necessary to identify each log with the parent tree.

Under favorable topographic conditions, diagraming of felled and bucked trees should be done where the trees are felled. If rough terrain creates unsafe or extremely awkward working conditions, the logs should be removed to level ground with as little damage to bark surfaces as possible. Orientation of grading faces of tree sections must be done before the logs are moved. (See below.) The procedures for diagraming logs not identified

with a tree should be the same as in diagraming felled and bucked trees or tree sections, with the exception of face orientation and numbering sequence.

Even under the best of conditions, diagraming logs is a rather slow and tedious operation. Because large numbers of logs are generally needed to complete a particular study, and the time available for training and diagraming is usually limited, the following procedural outline should be used as a guide to insure efficient and accurate recording of data.

Procedural Details

1. Start diagraming at the stump end of the tree. (Not applicable for logs at landing or deck.) Diagram each unit in its proper sequence, continuing up the stem. The orientation line previously placed on the log surface will always be the dividing line between faces 1 and 2 of the section to be diagramed (fig. 2). The first and most important step in proceeding to the next unit or section of the tree is the orientation of the grading faces on the diagramed unit. The faces must be oriented so that the diagrams may eventually be placed end-to-end so the entire tree can be visualized as it would look when standing, with all defects oriented horizontally and vertically in relation to each other.

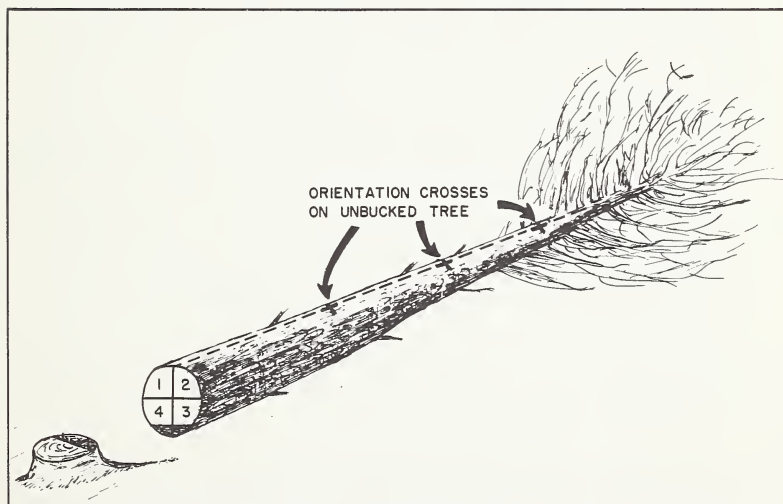


Figure 2. — Locating orientation marks on felled tree.

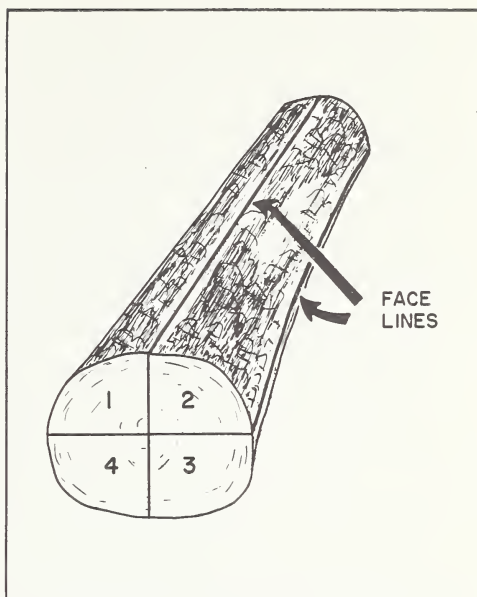
2. If the first section is a jump-cut, all the required information for it should be recorded exactly as described for diagraming usable sections. Measurement and sketching of end defects are particularly important here to determine whether or not the jump-cut was justified. If additional jump-cuts were made to eliminate more of the butt, each jump-cut should be completely diagramed and the length of each should be shown on the face diagrams. Do not put more than one jump-cut unit on a single diagram form.

Jump-cuts made farther up the bole to eliminate defective material or a fork or crotch should be handled in the same manner as lower jump-cuts. Measurement and sketching of end defects on all jump-cuts are also particularly important for determining whether or not the cut was justified.

3. The long and short axis diameters inside the bark at the large end of the log should be measured and recorded to the nearest 0.2 inch (except to nearest inch for the butt end of butt logs) in the space provided below the cross-section diagrams.
4. The shape of the end when substantially off-round should be sketched to scale, and the type and size of all end defects should be shown on the appropriate cross-section diagram. For defects visible at an end that may extend into the bolt or log, the extent of the non-visible area should be estimated and sketched on the surface diagram with dotted lines, and the estimated length should then be recorded.
5. The location of log faces should be indicated with colored paint, felt-tipped ink markers, chalk, or other material on both ends of the log. Face border lines should be extended on the surface of the log. This can be done with plastic tape stretched the full length of the log or with chalk stick or chalk line (fig. 3). Chalking seems to be the better method in rough brushy forest conditions, and plastic tape seems to work especially well on flat open situations such as a log deck or mill yard. The faces should be numbered in a clockwise sequence as seen at the butt end of the log and looking toward the small end.

For ease in efficient recording of defects it is usually best to orient the log faces in such a manner that faces 1 and 2 are *up* at the beginning of recording as indicated in sketch.

Figure 3.—Log with diagramming faces numbered and face borders marked on log end surfaces.



After completing the record of defects on faces 1 and 2, turn the log 180° in either direction and complete faces 3 and 4.

6. A measuring tape or lightweight wood measuring stick 16 feet long and hinged in the middle for ease in transportation can be used. Start at the butt end and work toward the small end. The tape or stick should be fitted with some device to hook over the butt end. This is necessary because the tape or stick should remain in place while you are determining the exact location of the surface characteristics. The length of the log should be measured and recorded at the top of the form in feet and inches.
7. The diameter and defects at the small end of the log or section should be measured, recorded, and identified the same as for the large end. For these purposes, use the small-end diagram in the lower right corner of the form.
8. The average width of the sapwood should be measured at the small end of the log to the nearest 0.1 inch and recorded in the space provided below the small-end diagram.
9. The surface of the log should be carefully examined for defects. Start at the large end and work toward the small end along one or two faces.

10. Indicate the center of each defect by a dot placed in the correct location on the diagram form. Around the dot, sketch the shape and relative size of the log knot or other defect. It is important that the exact vertical and horizontal size (measurements parallel and at a right angle to the ground as a tree grows) of each surface defect be shown accurately on the form. Vertical size is relatively simple, because vertical scale on the diagram is fixed. However, horizontal scale varies with the diameter of the log being diagramed. For example, a surface defect 4 inches wide will occupy a greater portion of the face on a 10-inch long log than it will on a 20-inch log. Each defect should be sketched so that it occupies vertical and horizontal space on the diagram corresponding to the portion of the face it actually covers.
11. Record the identifying symbol to the side of the sketch. Below the symbol, show the dimensions of the defect, always in the sequence: length, width, and—where required—height or depth.
12. As each defect is recorded it should be marked on the log with colored chalk to indicate that it has been recorded.
13. After the two *up* faces have been diagramed, remove the measuring tape or stick and roll the log so that the *down* faces are exposed. A lever hoist is very convenient for rolling extremely large logs to expose the No. 3 and No. 4 faces. If the plastic tapes used to outline the faces are disturbed during rolling, they should be realigned. The measuring tape or stick should be lined up as before and the defects on faces 3 and 4 should be recorded. Pay particular attention to the edges of the No. 1 and No. 2 faces, which adjoin faces 3 and 4, for defects that may have been missed earlier.
14. Check condition of the log number previously put on the section by the tree selection and measurement crew. Repair or replace it if necessary. Sections not a part of a tree diagram should be given a number at time of diagraming, and numbered metal tags or crayon, should be used to identify the section.
15. When the last log or cut has been diagramed, inspect the material remaining in the unutilized top of the tree to see whether any merchantable material (by merchantability standards established for the specific study) has been left.

Most commercial bucking operations reveal many cases where such material could have added length to the last log or could have produced a separate log. In some cases this material may be above a fork or crotch. Material that could have been utilized for the product being cut should be diagramed, and the diagram form should be clearly labeled to indicate that it is usable material left as residue.

Control of bucking procedures by study personnel can avoid such under-utilization, and should be a part of the study plan whenever practicable. On specific product studies where merchantability limits exclude material suitable for pulpwood or other small piece products, the total length of such below-standard material in the top should be determined and recorded. This will generally include material in the central stem and in limbs at least 4 inches in diameter and reasonably straight (ratio of 1:4 small-end diameter/maximum departure.)

The total length of such material (except in multiple-stem trees) will generally be less than 16 feet, and the length can be recorded on one diagram form (clearly labeled as *below standard material*). The extent of diagramming detail should be covered in the work plan, and should be limited to diameter, length, degree of crook or sweep, extent of rot, and size and condition of average or maximum knots.



APPENDIX

Training

The accuracy of appraising the relation between visible characteristics and product or value yield depends almost entirely upon the information recorded on the diagram form. Therefore, the diagrammer must be familiar with the factors known to affect log and tree quality, quality specifications for products, and techniques used for converting logs and trees into products. Before doing any diagraming, the person should be thoroughly trained and experienced in the principles and practices of grading logs.

This publication is not intended to be a substitute for training and experience in diagraming. Rather, it is a guide for the trained man; and at the same time it can be useful for training the inexperienced man.

Crew Organization and Duties

Crew leader. Usually the study leader. He trains, supervises, and checks accuracy of diagramers.

Growth ring counter (optional). Makes all growth rate and ring counts and conveys this information to diagraming teams.

Log preparer. Usually necessary when diagraming material at the stump, particularly when underbrush is heavy and the ground is rough and irregular. Removes interfering brush and slash so that the log can be rolled easily. If he has extra time, he can also put face lines on log surfaces and ends.

Diagraming team.

Caller. — The duties of the caller include:

- (a) Positioning log, if necessary, with orientation line up.
- (b) Placing measuring stick on log.
- (c) Marking face lines on log ends and bark surfaces and numbering them.
- (d) Taking diameter and length measurements and calling measurements to recorder.
- (e) Taking bark and sapwood measurements and calling measurements to recorder.
- (f) Checking and measuring crook and sweep and calling results to recorder.
- (g) Locating position, identification, and measurement of bark surface characteristics (by faces), and calling information to recorder.

Recorder. — The duties of the recorder include:

- (a) Filling in headings for log identification as required.
- (b) Diagraming location of log end and bark surface characteristics.
- (c) Recording diameter, length, sweep, and other measurements from caller.
- (d) Assisting caller in locating and identifying log defects.

Equipment for Diagraming

1. Supply of diagram Form ESLPG-1 and instructions.
2. Pencils, 2-H or No. 3.
3. Tally board (size to accommodate diagram form).
4. Colored keel, chalk, felt-tipped markers (black), or other marking material. Paint gun and supply of blue or red paint.
5. A 50-foot steel tape (fitted with hook end), and/or 16-foot measuring stick (hinged).
6. 6-foot steel tape graduated in tenths of inches.
7. 6-inch rule graduated in tenths of inches.
8. Two cant hooks or peavies.
9. Ax.
10. Lever hoist and binder chain and grab hooks.
11. Swedish bark punch.
12. Probe for determining depth of some types of defect.
13. A good forest pathology reference.

Safety

Log and tree diagraming can be extremely hazardous. All safety precautions as listed in the Forest Service Safety Code should be conscientiously observed when diagraming logs or trees.

Some Do's

- Wear a hard hat when working in the woods.
- When turnings logs with a cant hook or peavy, have the hook firmly planted in the log before applying pressure to the handle.
- Have your feet firmly placed on the ground before attempting to turn a log.
- When turning logs, lift with your legs and not your back.

Some Don'ts

- Don't work alone.
- Don't forget that falling trees leave broken branches and debris dangling overhead that may fall while you are in the area.
- Don't forget that the area around a tree that has been felled may contain sharp stubs or brush and small trees that were cut.
- Don't attempt to turn a log from the downhill side.
- Don't move a log until you are sure it will not set all or part of the remaining tree in motion with disastrous results.
- Don't forget that moving a log may release saplings that are sprung over and bound down by the fallen tree.

BARK-SURFACE CHARACTERISTICS SYMBOLS

(from form ESLGP-1)

110 Bark distortion (D)	111 Flutes (Flt)	*110 Adventitious (AB)
Bird peck:	Holes (Worm)	111 Mechanical damage (MD)
*110 Open (OBPk)	*110 Pin (WH-P)	111 Sap rot (SR)
*110 Closed (CBPk)	*110 Medium (WH-M)	Seams:
112 Blister rust (BRT)	*110 Large (WH-L)	111 Open, sound (OSS)
*101 Bulge (Bu)	222 Holes (other large-OH)	111 Open, unsound (USS)
112 Bump (B)	Log knots:	110 Overgrown (GS)
112 Burl (Bl)	* D Live (○)	(show cause)
112 Butt scar (BS)	* D Dead (●)	*101 Sweep (Swp)
102 Butt swell (SW1)	* D Rotten (○ R or ● R)	112 Surface rise (SUR)
111 Canker (Ca)	* D Punk (● P)	111 Undercut (UC)
220 Conk (Co)	* D Bleeding (● RB or ● PB)	— Weevil injury (W)
*101 Crook (CK)	— Acute-angled	Wounds or scars
111 Flanges (Flg)	* D Overgrown (X)	Sound (SW)
	112 Knot cluster (KCL)	111 Unsound (UN)

LOG-END CHARACTERISTICS SYMBOLS

220 Bark pockets' (BP)	*180 Heart check (HC)	280 Pitch pockets (PP)
*110 Bird peck (BPk)	110 Holes (Worm)	180 Pitch ring (PR)
*110 Bulge (Bu)	(use log-surface codes)	180 Ring shake (RS)
120 Bump (B)	222 Holes (other large OH)	Rot:
120 Burl (Bl)	*D Log knots:	110 Butt rot (BR)
220 Butt scar (BS)	(use log-surface codes)	110 Trunk rot (TR)
*110 Butt swell (SW1)	*100 Off-center pith (OC)	110 Sap rot (SR)
110 Compression wood (CW)	111 Mechanical damage (MD)	111 Seams: (use log-surface code)
* Double pith (DP)	110 Pitch, massed (MP)	110 Stain (ST)
*110 Flanges (Flg)		120 Surface rise (SUR)
110 Flutes (Flt)		111 Wounds (use log-surface code)

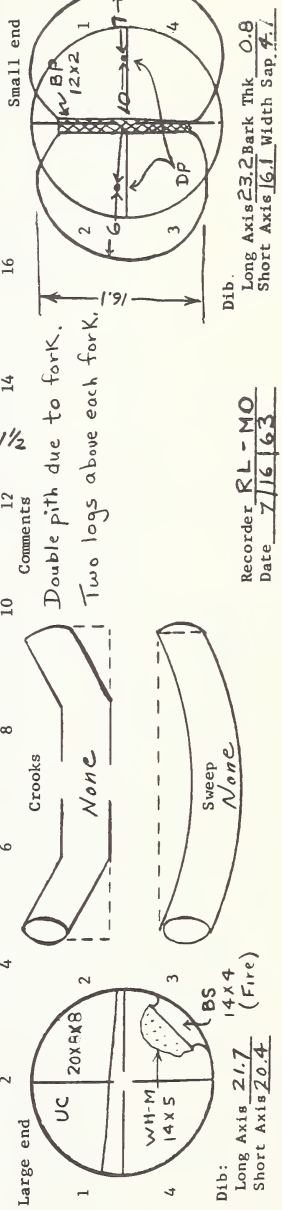
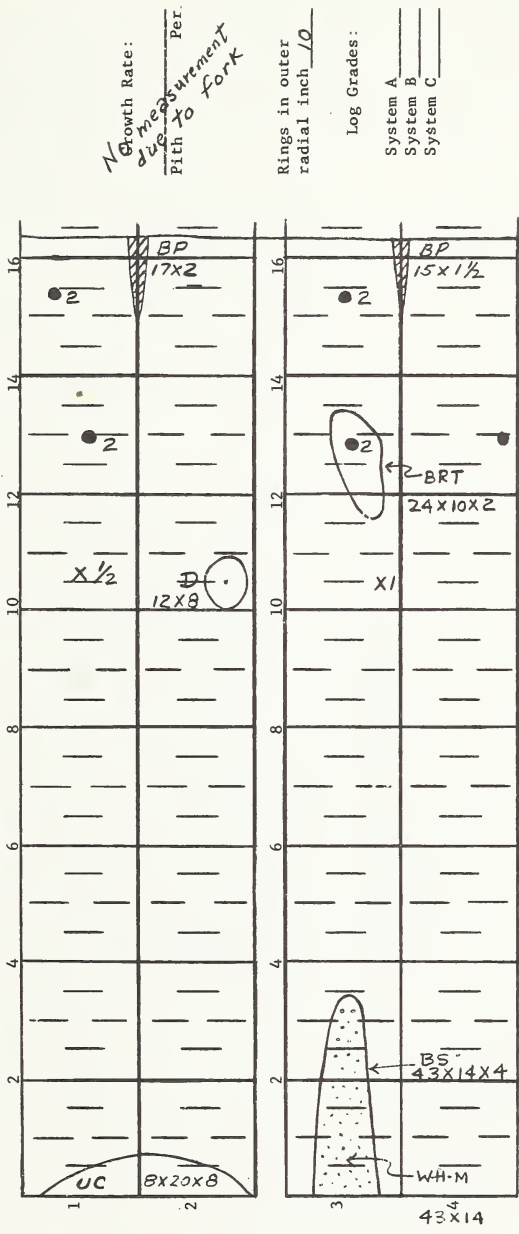
*Special type of measurement.

NOTE: The number at left of the defect name indicates the dimension measurements that are to be recorded for the defect. The first digit refers to length, the second to width, and the third to depth or height. The numeral "1" indicates that the measurement should be taken to the nearest inch, "2" to the nearest 1/2 inch, "4" to the nearest 1/4 inch, "8" to the nearest 1/8 inch, and "0" indicates that no measurement is required for the dimension. For example: the number "111" means measure length, width, and height (or depth) measurement is required. "D" in the column indicates that an average diameter measurement is to be taken.

Tree No. 21 of 5
Section No. 1 of 5
Diagram No. 1 of 1
Product Saw log
Species Red Pine (125)

Mill or Operation CHIPPENAW #1
Location Ojibway
Scaling Diameter 164
Length 164

Gross Scale _____ Int. 1/4" _____ Scrib Dec. C _____
Scale Deductions: _____
Swp or Ck. _____ Int. 1/4" _____ Scrib Dec. C _____
Rot _____ " _____ " _____
Other _____ " _____ " _____
Net Scale _____ " _____ " _____



7/63)

Gross Scale	Int. 1/4"	Scrib Dec. C
Scale Deductions:		
Swp or Ck.	Int. 1/4"	Scrib Dec. C
Rot	" "	" "
Other	" "	" "
Net Scale	" "	" "

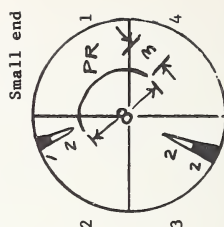
Growth Rate:

	Per.
Pitb.	

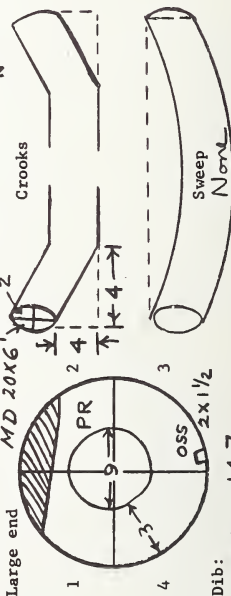
Rings in outer
radial inch | 4

Log Grades:

System A
System B
System C



Small end



Comments

Dib:

$$\begin{array}{r} \text{Long Axis } 14.7 \\ \text{Short Axis } 14.1 \end{array}$$

Recorder JB-DL

Date 8/29/63

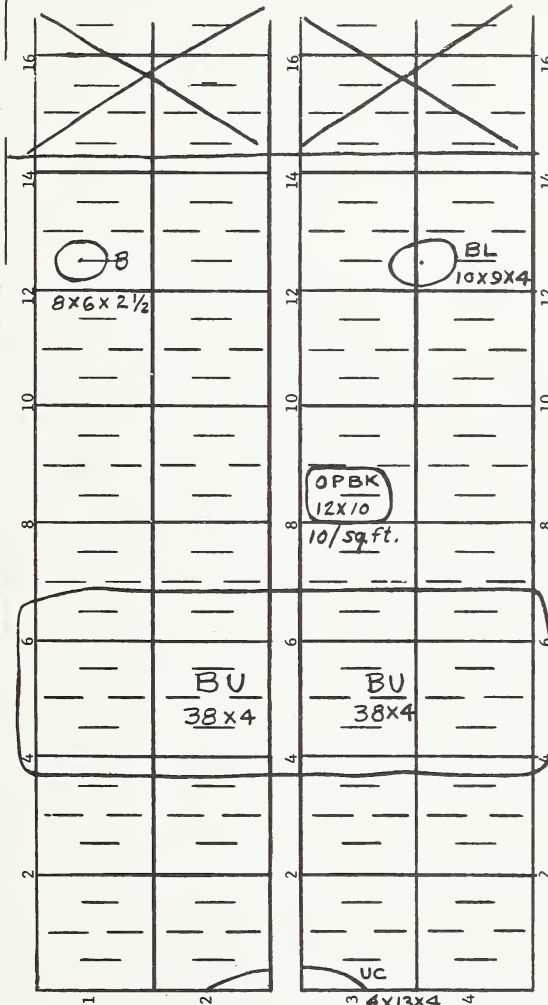
Dib.

Long Axis 2.9 Bark Thk 0.4
Short Axis 2.3 Width Sap 4.2

Tree No. 92
 Section No. 1 of 3
 Diagram No. — of —
 Product Sawlog
 Species Red pine (125)

Mill or Operation Red Lake (#2) Gross Scale Int. 1/4" Scrib Dec. C
 Location J. Johnson Trail Scale Deductions: Int. 1/4" Scrib Dec. C
 Spp or Ck. " " " " "
 Rot " " " " "
 Other " " " " "
 Net Scale " " " " "

Scaling Diameter 14.4
 Length 14.4

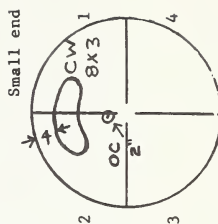


Growth Rate:

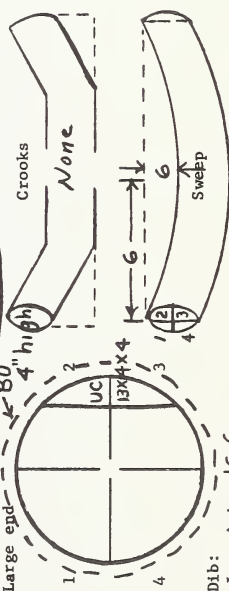
3	2 1/2	1
7	10	14

Rings in outer radial inch 14

Log Grades:
 System A
 System B
 System C



Comments



Dib.
 Long Axis 13.1 Bark Thk 0.7
 Short Axis 12.8 Width Sap 3.9

Recorder EO-MO
 Date 11/20/63

Dib:
 Long Axis 16.6
 Short Axis 16.0

